

Soils 5.02... the low down and dirty! P:5

Essential Questions (means that if you can't answer this at the end, we need to do it again!)

How do you describe horticultural soils?

How do you interpret the relationship between the soil profile, soil structure, soil texture, pH, and other properties of soil as they relate to plant growth?

How do you prepare a soil sample?

Vocabulary Word Wall

Soil	Soil Profile	Soil Structure
Soil Texture	Soil pH	Soil Permeability
Aeration	Tilth	Soil Science
Erosion	WHC	Soil Conservation

Objective: Interpret the relationship between soil properties and plant growth .

Key terms: soil profile, soil structure, soil texture, pH

Soil Profile

1. What is a soil profile?
2. What is another name for layers of a soil profile?
3. What are the following horizons? Describe each.

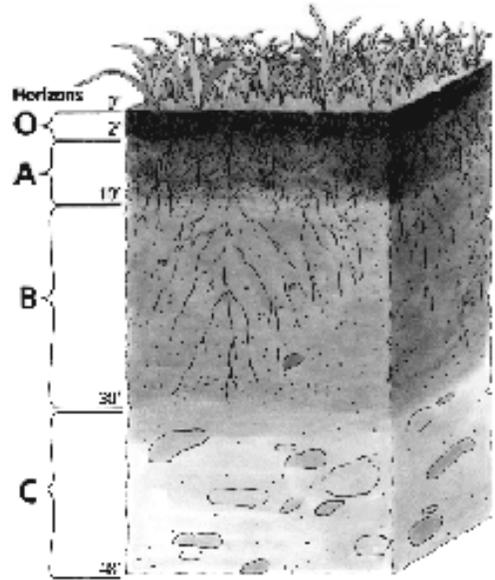
O:

A:

B:

C:

R:



4. We are now going to create our own soil profile.
 1. Attach the piece of tape to the sheet on the strip next to where it shows the horizons (on the left)
 2. Leave the covering on the side that is not sticking to the paper.
 3. Slowly remove the tape covering down to the 24” mark. Affix the topsoil horizon sample.
 4. Remove the tape covering down to the 48” mark and affix the subsoil horizon.
 5. Remove the tape covering down to the 72” mark and put on the bedrock layer.

Horizon Questions:

1. What do you notice about the change in color from the A horizon to the C horizon?
2. Why do you think that there is a change in the darkness of the color in the C horizon?
3. Why is the A horizon so deep and black?
4. When new homes are built, they often scrape off the A horizon and leave the B horizon for the homeowner (construction dudes sell the topsoil). What could you do if you were left with the B horizon to grow plants in? How could you improve this horizon?

Soil Name _____

Horizon

	0"	
A	12"	
	24"	
B	36"	
	48"	
C	60"	
	72"	

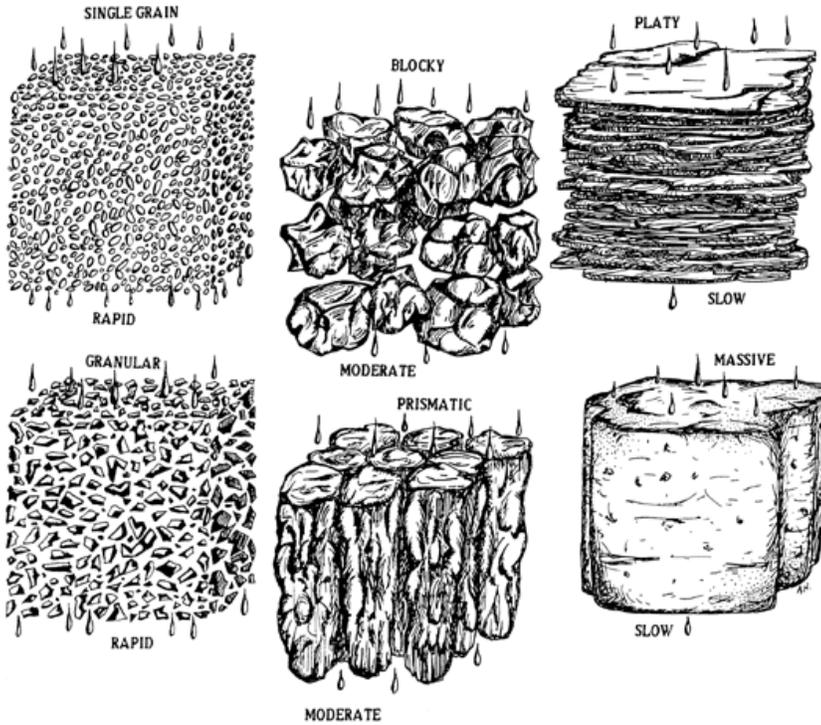
<http://soils.usda.gov>

Soil Structure:

1. What is soil structure?

Soil structure is the way in which the individual particles—sand, silt, and clay—are arranged into larger distinct aggregates. These aggregates are called peds and can usually be separated easily, particularly in dry soil. Structure is the major factor determining how fast air and water enter and move through the soil. The main types of soil structure are granular, platy, blocky, prismatic, and columnar. Soil may not have a visible structure because it is either single grain or massive. These types of structure are shown in the diagrams below.

2. From smallest particle to structure: Single grain of sand, silt or clay > aggregates > peds



By looking at this diagram on the left, which soil structure allows water to drain the quickest?

The slowest?

What could be done to a soil to make it have poor soil structure?

- 1.
- 2.
- 3.

What could be done to soil to improve its structure?

- 1.
- 2.
- 3.

Listed below are the different types of soil structure. Fill in the characteristics of each soil structure next to the name of the structure.

Granular:

Platy:

Blocky:

Prismatic:

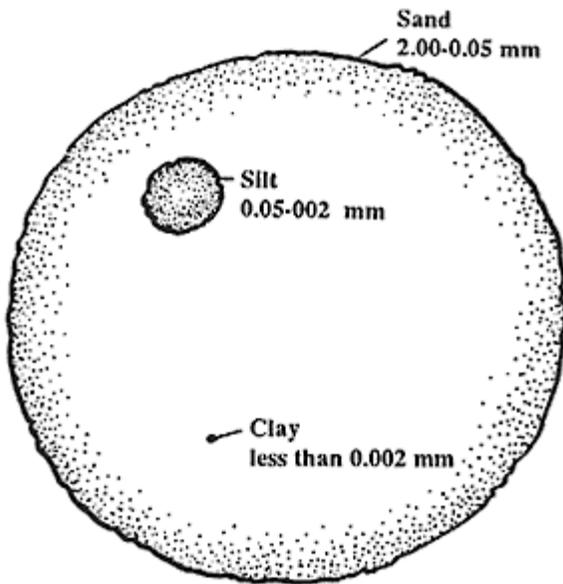
Categories with no visible structure

Massive:

Single Grain:



Soil Texture: Texture is the feel of the soil. It has to do with the amount of the following three types of particles:



Sand:

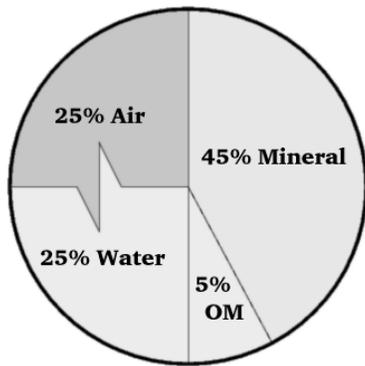
Silt:

Clay:

1. How does particle size impact Water Holding Capacity (WHC)?
2. Which has a higher WHC, sand or clay? Why?

When sand, silt, and clay combine in even parts (about 33% each) the texture is known as *Loam*. A loam is the ideal soil texture to have for growing plants. Why would Loam textured soils be the best for growing plants?

Soil Sample: A typical soil sample is made up of about 45% minerals (rocks), 5% organic material, 25% water, and 25% air.



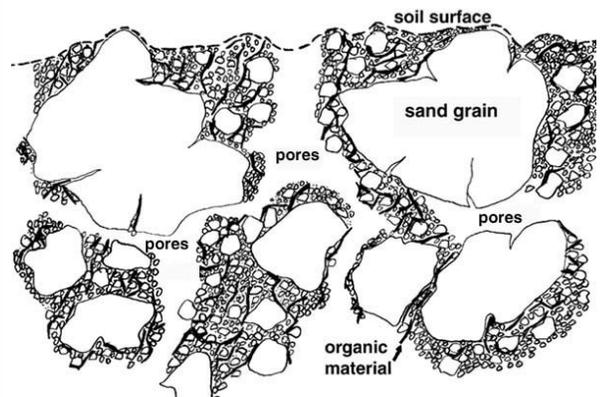
In a soil sample (like the one to the bottom of the page), half of the material is solid (organic material and mineral). The other half is air and water. Use a highlighter to show where all of the pore spaces. The pore spaces are either filled with air or water. What is something else that could fill the pore spaces?

What is soil permeability?

Pore Spaces : The soil sample has pore spaces.

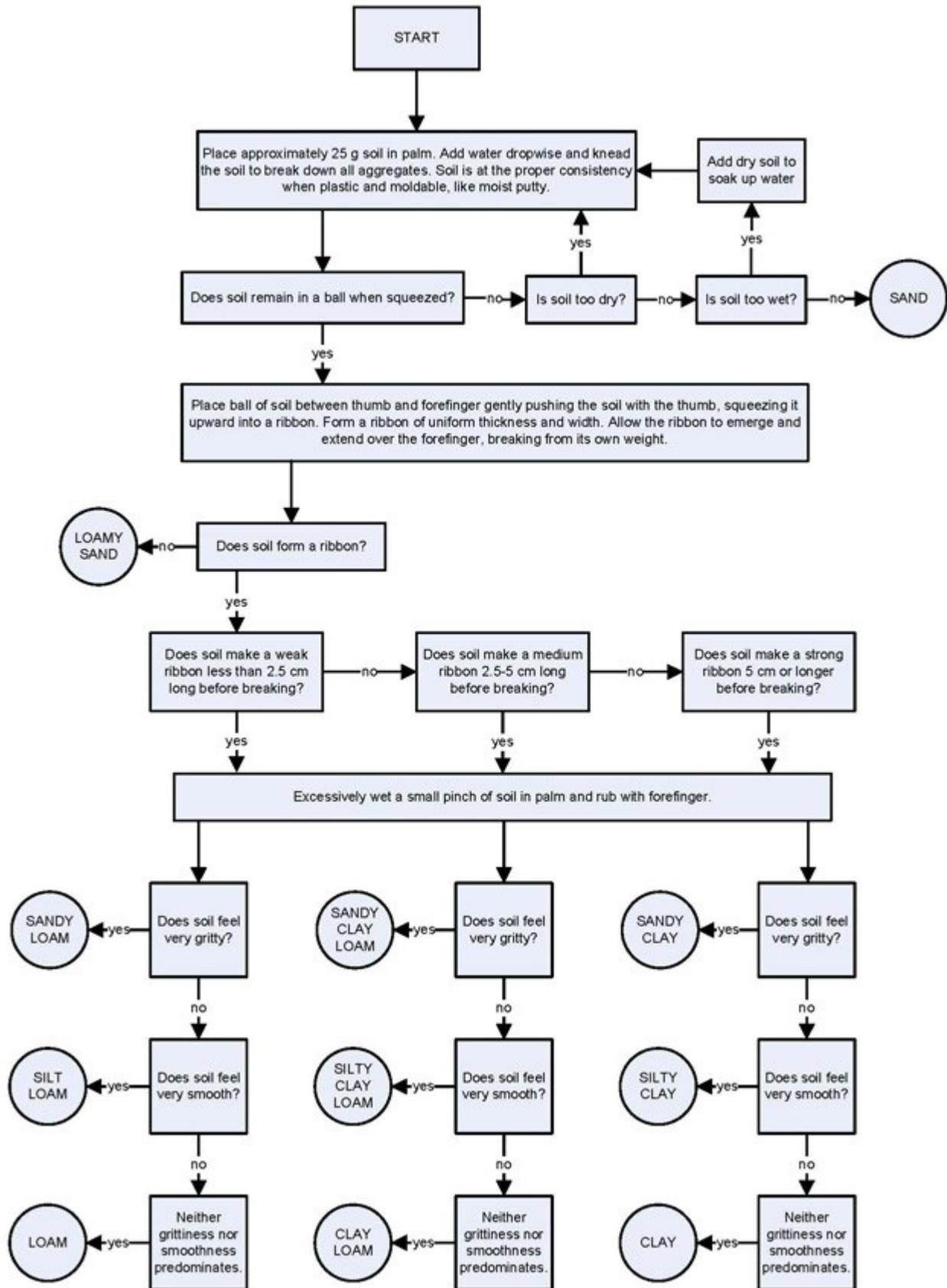
What are pore spaces?

When the pore spaces have both water and air, the soil is at _____ capacity. If the pores are all air, the plants would be _____. If the pore spaces in the soil are filled with water, this is known as being _____. When a sample is saturated (all of the pores are filled with water) the plant cannot breathe or respire, therefore the plant will ultimately die.



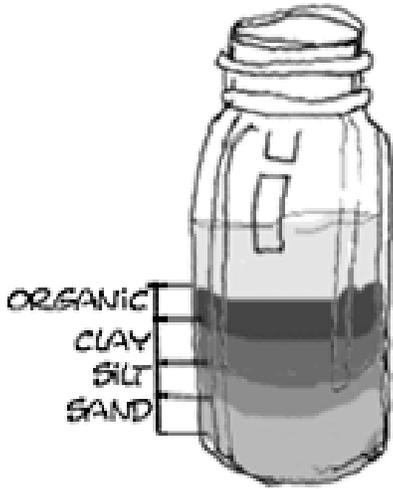
Soil Texture Key for a Soil Ribbon Test

Using the key below, we are going to determine our soil sample's texture.



What is your soil sample's texture?

Soil Texture Determination (Soil Shake)



Sometimes when you are determining a soil's texture by feel (using the ribbon test) an individual can be subjective. This means, that the feel (gritty, smooth, etc) could be felt differently by different people. So, to be a little bit more technical and more objective, we can shake up a soil sample and measure layers of sand, silt, and clay.

1. Take your bottle and fill it half way with your soil sample.
2. Add a drop of soap and fill with water.
3. Shake for one minute.
4. Put your name on the top of the bottle.
5. Tomorrow, you will measure the layers of sand, silt, and clay.
6. Sand will settle first, because it is the densest, then silt, and finally clay. The floating stuff in the water is organic material (dead stuff floats right?)

Determining percentages of sand, silt, and clay.

1. Measure the entire sample (only sand, silt, and clay layers (nor organic stuff)). _____ mm
2. Measure the sand layer. _____ mm
3. Measure the silt layer. _____ mm
4. Measure the clay layer. _____ mm
5. Now, determine the percentages of sand, silt, and clay.

% Sand #2/#1 = _____ % Sand
 % Silt #3/#1 = _____ % Silt
 % Clay #4/#1 = _____ % Clay

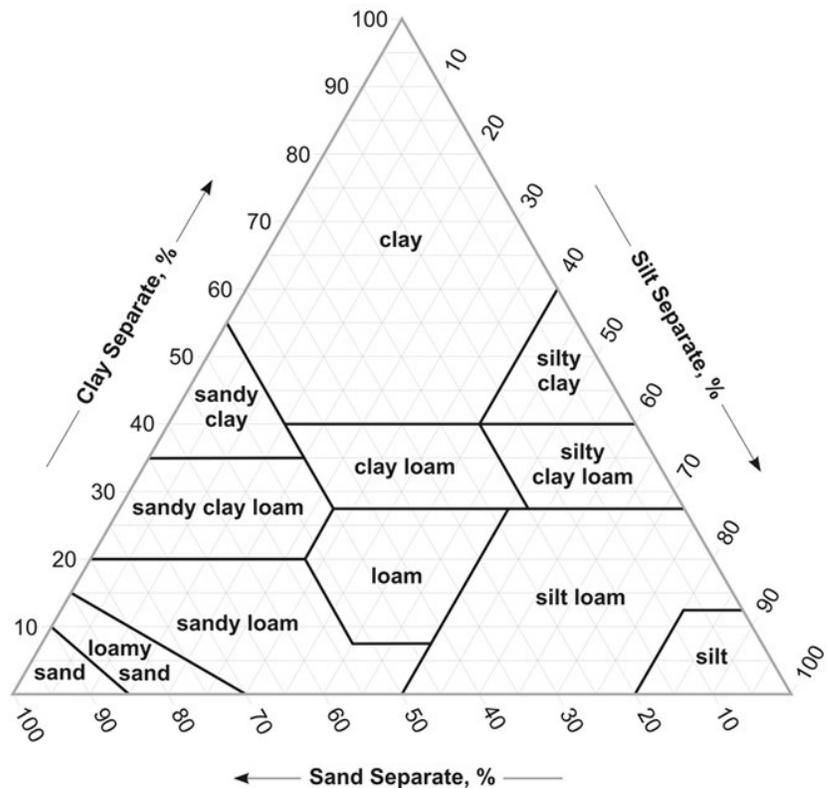
Using your percentages and the soil texture triangle to the right, Follow the arrows. Draw a line from the appropriate percentage mark. This means, if you have a 50% sand sample, draw a line at the 50% mark of sand. Where all three of the lines intersect, this is your sample's texture.

What is your soil's texture?

Is the result of this soil texture analysis the same as yesterday, using the ribbon test?

If not, why do you think it is different?

Which is more accurate, the ribbon test or using a texture triangle.



Understanding Texture Triangle:

1. What texture do you have if you have 33% sand, 33% silt, and 34% clay?
2. What texture do you have if you have 34% silt, 10% sand and 56% clay?

SOIL PH

1. WHAT IS IT?
2. WHAT IS A NEUTRAL PH?
3. WHAT IS AN ACIDIC PH?
4. WHAT IS AN ALKALINE PH?
5. NAME SOMETHING ACIDIC THAT IS ORGANIC.



HYDRANGEA- IS IT BLUE OR PINK?

HYDRANGEAS CHANGE COLOR DEPENDING UPON THEIR PH.

WHAT COLOR WILL A HYDRANGEA BE IN ACIDIC SOIL?

WHAT COLOR WILL A HYDRANGEA BE IN ALKALINE SOIL?

WHAT CAN SOMEONE DO TO MAKE A PINK HYDRANGEA BLUE?

WHAT CAN SOMEONE DO TO MAKE A BLUE HYDRANGEA PINK?

LET'S CHECK OUT SOME PH READINGS...YOU AND YOUR GROUP NEED TO FIGURE OUT THE PH OF THE MYSTERY LIQUIDS. CHECK THEM OUT. GUESS WHAT THEY ARE. BE MYSTIFIED!

Sample	What you think it is	pH	What it actually is
Red			
Green			
Yellow			

WHAT IS THE IDEAL PH OF MOST ORNAMENTAL AND EDIBLE PLANTS?

WHAT IS THE ANALOGY TO HAVING THE CORRECT PH (THINK OF A REFRIGERATOR).

Soil Samples: The only way to get a 100% accurate test of your soil is to gather a sample from your garden and send it to a pedologist.

1. What is a pedologist?
2. What agency would accept a soil sample for testing in North Carolina?
3. Where would you send these soil samples?
4. How much does a soil test cost?
5. Why would you take a soil sample for testing?



Soil Sampling 101

1. You should take a soil sample in the _____ season that you plan to start your garden. Why would you do this?
2. When taking a soil sample, how deep should you take your samples?
3. How many soil samples (cores or slices) should you take from a uniform area?
4. What tools should you use when taking your sample?
5. What should be removed from the sample?
6. How much of your sample should you send to the NC Cooperative Extension Agency?
7. How long does it usually take to get your sample returned?
8. What is the difference between the NC Cooperative Extension and the NC Department of Agriculture?

"We're taking soil samples today ...
in other words, FIELD TRIP!"

Interpreting Soil Sample Data

When you get back your soil sample results, what are five things you would find on your soil test data?

- 1.
- 2.
- 3.
- 4.
- 5.

The results will state how to improve your soil and give recommendations for how to amend the soil in a way that will prepare the soil for the specified crop (meaning, if you said you wanted to plant grass in that garden, they would give you information about how to make the soil better for grass.)

Using Wakefield's soil sample results, determine the answers to the following questions.

1. What crop did Wakefield plan to grow?
2. How much lime should be added per acre to the soil?
3. Will adding lime increase or decrease the soil pH? Make it more acidic or more alkaline?
4. What is the pH of the soil right now?
5. What is HM and how much is in there?

Your Own Soil Samples: A Do it Yourself test! Test

You and your group will determine how Wakefield High School's vegetable garden is stacking up as a soil. You and your group will read the directions and figure out some pretty sweet information about our soils. So, today, you will be a soil pedologist. Rock on.. Get it?

Using the Mosser Lee Soil Master Soil Testing Kit, determine the following information:

Soil Samples

1. How many soil samples should be taken from the vegetable garden? The area is 60 feet long by 20 feet wide?
2. How much of the sample do you need to bring back to the classroom?

pH

1. What is the pH of your soil?
2. Is this the right pH for growing vegetables?
3. What is the appropriate pH for growing vegetables?
4. If not, how should the soil be amended to change the pH?

Nitrogen

1. How much Nitrogen shows up in the soil test?
2. Is this an adequate amount?
3. If not, what does the Mosser Lee reading suggest to do to add Nitrogen to the garden?

Phosphorus

1. Was the Phosphorus reading low, medium, or high?
2. Does anything need to be added to the site to increase Phosphorus levels?
3. If it is already high, how do you think that it became this way?

Potassium

1. Was the potassium reading low, medium, or high?
2. If there is not enough, how much should be added to the site?

Extension

1. If I am having difficulties understanding this or any other soil test report, whom should I contact?
2. What are the two universities that can help me better understand soil test reports in North Carolina?

Soil Erosion and Soil Conservation

1. What is soil erosion?
2. Go out to a space on campus that illustrates what erosion is. Take a picture with your group and show it to Mrs. Riedel. What are five things that make you think that this is an example of erosion?
 - A.
 - B.
 - C.
 - D.
 - E.
3. Hypothesize how this erosion issue started.

4. Research how you could better this situation. What are five practices or changes that could be made to this site to help combat or control erosion?
 - A.
 - B.
 - C.
 - D.
 - E.
5. Develop a plan of action to help control erosion on this site. List your steps in the space provided.

6. Why do you think your plan will be effective in helping this erosion problem?

7. Why is soil conservation essential for your life and the sustainability of the earth?

8. How do you think the current growth in population will impact soil conservation?

9. What was the Dust Bowl? How was this a result of failure to conserve soil?

10. There are a number of new technologies that are being employed to help with soil conservation. One is PAM.
 - A. How does this work?

 - B. What are the advantages of using a product like this?

 - C. Research this product on the web. What are some problems associated with this product?